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# Prevalence of behavioral risk factors in people with HIV/AIDS and its' effect on adherence to treatment

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## Abstract

**Introduction:** Behavioral risk factors, in addition to increasing the risk of human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) transmission, can affect antiretroviral therapy (ART) compliance of people with the condition. The aim of this study was to determine the prevalence of behavioral risk factors and its' effect on adherence to antiretroviral drugs (ARV) treatment in patients with HIV/AIDS in Western Iran.

**Material and methods:** This study was performed among all patients diagnosed with HIV/AIDS in Kermanshah Province for 25 years, from 1995 till 2019. Adherence to treatment in these patients was divided into three categories according to the World Health Organization definition, i.e., non-adherence, cessation, and adherence to treatment. Using single-variable and multi-variable logistic regression, the effect of important variables in four models was modified, and the effect of each of behavioral risk factors was analyzed in patients with non-adherence or experienced cessation compared to those who adhered to ARV.

**Results:** Of the 2,867 patients with HIV/AIDS, 2,449 (85.42%) were males. The mean age of HIV infection was 33.36 ± 11.8 years. In 1995, less than 10 percent of people received treatment, and in 2019, it was more than 67 percent. All behavioral risk factors increased non-adherence to medication and cessation of ARV. In general, after controlling confounding variables, except for needle sharing, all behavioral variables affected ARV treatment. The greatest impact on non-adherence to medication was history of drug abuse, history of imprisonment, history of injection drug use, and sex with non-spouse, with a chance of 10.87 (range, 7.21-16.39), 3.94 (range, 2.84-5.46), 3.86 (range, 2.47-6.03), and 3.38 (range, 2.19-5.23) times more than patients without these risk factors, respectively.

**Conclusions:** Although the process of receiving treatment has been increasing since 2005, the non-adherence to medication is still high in high-risk groups; therefore it is important to focus more on reducing non-adherence and eventual cessation of treatment. In particular, more attention is necessary for health education and raising the level of awareness of these groups.

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## Introduction

Human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) is one of the most serious challenges to global health and development. According to a World Health Organization's (WHO) report, in 2018, nearly 37.9 million people have been living with HIV worldwide, with only 23.3 million people receiving antiretroviral treatment, and 770,000 people have died from HIV/AIDS. In Iran, of the 61,000 individuals living with HIV, only 20% aged 15 and more were treated, and 2,600 died because of HIV/AIDS [1-3].

Antiretroviral treatment aims to slow the progression of HIV-related diseases, and improve quality of life of patients by suppressing proliferation of the virus in the body, and maintaining the function of immune system [4, 5]. According to the WHO antiretroviral therapy (ART) guidelines in 2010, with increasing threshold, ART eligibility in developed countries was revised from < 200 CD4+/mm$^3$ cells to < 350 CD4+/mm$^3$ cells [6]. Adverse antiretroviral drugs (ARV) reactions, pill tolerance, and complex diet can lead to problems, such as undesirable effect of antiretroviral drugs, sub-optimal therapy, cessation of treatment, and eventual failure of treatment. More than 78% of all cessation of treatments have resulted in treatment failure [7].

Drug injections are the most important cause of this epidemic in Iran. People who use drugs, especially those who inject drugs with shared needles or have unprotected sex, play a significant role in the high prevalence of HIV/AIDS. Drug use and related disorders are prominent barriers to adherence to ARV in people with the disease [8].

In general, there has been a significant reduction in the incidence of disease and mortality associated with HIV after the introduction of antiretroviral treatment, although this has not been successful among certain high-risk groups, such as injecting drug users, due to less adherence to medications [9].

In Iran, all steps of identification, HIV test, and treatment of these patients have been performed in all health centers, including counseling centers of the University of Medical Sciences, prison counseling centers, hospitals, blood transfusion centers, and rehabilitation organization's counseling centers, with affected people referred to a health deputy of relevant province. In these centers, individuals either come voluntarily for counseling, or have already a medical folder in a center. According to the Deputy Minister of Health, patients are treated based on treatment model provided by the WHO [10, 11].

Given the commitment to treatment to increase virus suppression, the reduction of HIV transmission is also important to decrease the effects of disease, especially in people with high-risk behaviors. Therefore, this study was conducted to investigate the effect of behavioral risk factors on adherence to antiretroviral treatment in patients with HIV/AIDS during 25 years of observation, from 1995 till 2019, in the Western part of Iran.

## Material and methods

### Study population

The present study was a cross-sectional study that examined data of all AIDS/HIV-positive patients in Kermanshah Province during the years of 1995-2019 (25 years). Kermanshah Province is the largest province in the Western part of Iran, with a population of nearly two million people, sharing border with Iraq.

In all health centers located in Kermanshah, people either come voluntarily for counseling or there are people who already have a medical folder in these centers. If a person comes voluntarily, after performing VCT (voluntary counseling and testing), a medical folder is formed and the person receives necessary services. There are persons who contact the center because of high-risk behaviors, voluntarily, or by telephone for more information. Those who have a medical folder or previously known cases are referred to relevant units upon arrival, and people with a history of addiction, sexually transmitted diseases (who are often voluntary counselors), or from other levels and organs, are referred to a center, such as the Ministry of Justice and Welfare State addicts' detention camps, prisons, health centers, hospitals, blood transfusion centers, private-sector physicians, etc.

### Data collection and measurements

In addition to demographic characteristics, behavioral risk factors and the status of tuberculosis and hepatitis B and C were recorded in collected information, and health status of an individual was followed-up till death. According to the World Health Organization's standard definitions and national guidelines, HIV-positive refers to a person who has antibodies in the body, and has been diagnosed with HIV through two positive tests and positive Western-blot test [12]. Also, according to the WHO definition, adherence to treatment is "The extent, to which the patient follows medical instructions" [13].

In this study, treatment status was grouped based on "adherence", with patients who received medication and were monitored according to defined protocols for receiving medication. In this group, patients received ARV treatment not later than 3 months back. "Cessation" was defined in patients who received medication, but due to certain factors, such as medication effects, lack of access to medication, imprisonment, death, etc. stopped the treatment (3 months or more from the last time of received medication). Finally, "non-adherence" was described in patients who did not receive treatment at all. It is worth mentioning that in patients with HIV, CD4+ T cell count was considered as appropriate laboratory indicator for determining progression of the disease, in which values below 200 per microliter of blood in absolute counting were considered as the scope of the disease crisis leading to AIDS symptoms. In this study, according to the start date of the first ARV treatment, viral load (VL) level was measured in individuals after 6 months of their first VL test.
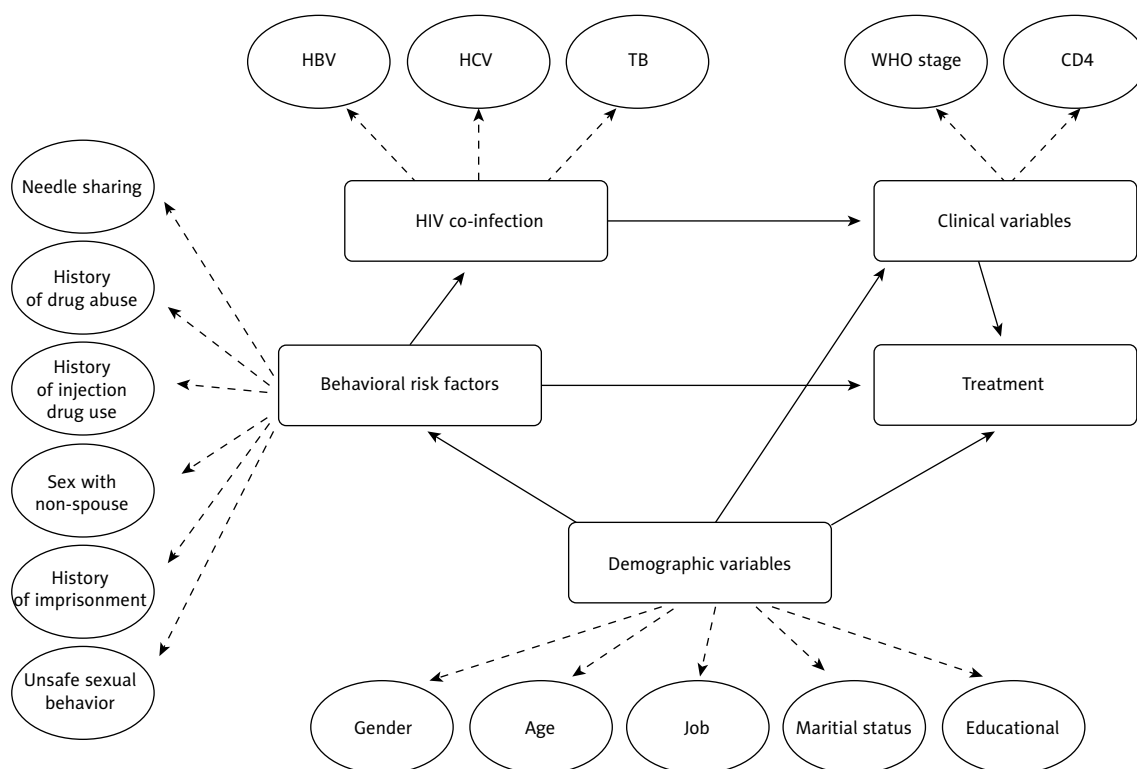
**Figure 1.** Conceptual model for modifying different factors on the effect of each behavioral risk factor on the treatment

### Inclusion and exclusion criteria

For the present study, all AIDS/HIV-positive patients who had at least one year of residency in the Province were included, and criteria for leaving the study were non-natives and people who had only come to the Province for testing, or continued treatment in follow-up health facilities of other Provinces.

### Analysis

In this study, in addition to describing the collected data using descriptive indicators, such as mean ± SD for quantitative data and ratio, and percentage for qualitative data, the effect on each of behavioral risk factors in patient adherence, non-adherence, and cessation of treatment compared to those receiving treatment was investigated. We aimed to evaluate variables on the treatment relying on the information available and the nature of variables. Variables were categorized into four groups, including demographic, co-infection, and clinical variables as well as behavioral risk factors. Based on multivariate logistic regression, single-variable and multivariate logistic regression were indicated, in which the effect of important variables in the four models was modified. In these four models examined based on a concept model shown in Figure 1, the base model was the same as Crude logistic regression value. First model involved modifying demographic variables (gender, age, marital status, occupa-

tion, and level of education). Second model, in addition to first model, included HIV/AIDS co-infections (concomitant HBV, HCV, and TB infections). Finally, third model, in addition to the above-mentioned variables, included clinical variables, i.e. HIV disease stage and CD4+ count. In this study, the significance level was considered to be less than 0.05. Less than 5% of missing data were considered for exclusion from the study. Data analysis was performed using STATA version 14 software.

### Ethical consideration

The present study was conducted according to the Helsinki Declaration [14]. The study was approved by ethics committee of the Vice Chancellery of Research and Technology, Kermanshah University of Medical Sciences (approval No., KUMS. REC. 1394. 315), and a written informed consent was obtained from each participant.

## Results

During the years of 1995 to 2019 (25 years), there were 2,867 HIV/AIDS patients identified, of which 2,449 (85.42%) were males. The average age of the study population was 33.47 years (95% CI: 33.92-34.02%), which was almost the same for men and women. The mean age of HIV/AIDS in women was 33.94 years (95% CI: 32.70-35.17%), and in men was 33.36 years (95% CI: 32.66-34.06%). The mean

**Table 1.** Demographic characteristics and behavioral risk factors of HIV/AIDS-positive patients according to the status of anti-retroviral treatment pattern

| Characteristics/ infection status | Total (%) | Non-adherence to ARV | Adherence to ARV | Cessation of ARV | p-value |
|---|---|---|---|---|---|
| Total (%) | 2,867 (100.00) | 1,817 (63.38) | 783 (27.31) | 267 (9.31) | |
| Gender | | | | | |
| Female | 418 (14.58) | 125 (29.90) | 254 (60.77) | 39 (9.33) | < 0.001 |
| Male | 2,449 (85.42) | 1,692 (69.09) | 529 (21.60) | 228 (9.31) | |
| Age | | | | | |
| < 18 | 465 (16.22) | 311 (66.88) | 121 (26.02) | 33 (7.10) | 0.054 |
| 19-29 | 1,322 (46.11) | 849 (64.22) | 346 (26.17) | 127 (9.61) | |
| 30-40 | 797 (27.80) | 500 (62.74) | 223 (27.98) | 74 (9.28) | |
| > 40 | 283 (9.87) | 157 (55.48) | 93 (32.86) | 33 (11.66) | |
| Job | | | | | |
| Unemployed | 1,364 (47.58) | 761 (55.79) | 456 (33.43) | 147 (10.78) | < 0.001 |
| Employed | 1,503 (52.42) | 1,056 (70.26) | 327 (21.76) | 120 (7.98) | |
| Education | | | | | |
| Illiterate | 27 7 (9.66) | 194 (70.04) | 57 (20.58) | 26 (9.39) | < 0.001 |
| Elementary | 700 (24.42) | 441 (63.00) | 200 (28.57) | 59 (8.43) | |
| Guidance | 939 (32.75) | 560 (59.64) | 270 (28.75) | 109 (11.61) | |
| High school and above | 559 (19.50) | 254 (45.44) | 250 (44.72) | 55 (9.84) | |
| Unknown | 392 (13.67) | 368 (93.88) | 6 (1.53) | 18 (4.59) | |
| Marital status | | | | | |
| Single | 1,280 (44.65) | 911 (71.17) | 257 (20.08) | 112 (8.75) | < 0.001 |
| Married | 861 (30.03) | 423 (49.13) | 355 (41.23) | 83 (9.64) | |
| Widow/divorce | 547 (19.08) | 338 (61.97) | 147 (26.87) | 62 (11.33) | |
| Unknown | 179 (6.24) | 145 (81.01) | 24 (13.41) | 10 (5.59) | |
| CD4+ cell count (cells/μl) | | | | | |
| ≤ 200 | 1,511 (52.70) | 1,117 (73.92) | 264 (17.47) | 130 (8.60) | < 0.001 |
| > 200 | 1,356 (47.30) | 700 (51.62) | 519 (38.27) | 137 (10.10) | |
| HBV | | | | | |
| No | 1,269 (44.26) | 545 (42.95) | 174 (11.60) | 122 (8.13) | < 0.001 |
| Yes | 98 (3.42) | 68 (69.39) | 20 (20.41) | 10 (10.20) | |
| Unknown | 1,500 (52.32) | 1,204 (80.27) | 589 (46.41) | 135 (10.64) | |
| HCV | | | | | |
| No | 1,256 (43.81) | 586 (46.66) | 535 (42.60) | 135 (10.75) | < 0.001 |
| Yes | 394 (13.74) | 184 (46.70) | 146 (37.06) | 64 (16.24) | |
| Unknown | 1,217 (42.45) | 1,047 (86.03) | 102 (8.38) | 68 (5.59) | |
| TB | | | | | |
| No | 2,091 (72.93) | 1,247 (59.64) | 639 (30.56) | 205 (9.80) | < 0.001 |
| Yes | 776 (27.07) | 570 (73.45) | 144 (18.56) | 62 (7.99) | |
| Needle sharing | | | | | |
| Yes | 1,584 (55.25) | 1,118 (70.58) | 317 (20.01) | 149 (9.41) | < 0.001 |
| No | 83 (2.90) | 45 (54.22) | 28 (33.73) | 10 (12.05) | |
| Unknown | 1,200 (41.86) | 654 (54.50) | 438 (36.50) | 108 (9.41) | |

**Table 1.** Cont.

| Characteristics/ infection status | Total (%) | Non-adherence to ARV | Adherence to ARV | Cessation of ARV | *p*-value |
|---|---|---|---|---|---|
| Total (%) | 2,867 (100.00) | 1,817 (63.38) | 783 (27.31) | 267 (9.31) | |
| History of drug abuse | | | | | |
| Yes | 2,143 (74.75) | 1,486 (69.34) | 449 (20.95) | 208 (9.71) | < 0.001 |
| No | 447 (15.59) | 87 (19.46) | 325 (72.71) | 35 (7.83) | |
| Unknown | 277 (9.66) | 244 (88.09) | 9 (3.25) | 24 (8.66) | |
| History of injection drug use | | | | | |
| Yes | 1,967 (68.61) | 1,433 (72.85) | 352 (17.90) | 182 (9.25) | < 0.001 |
| No | 176 (6.14) | 69 (39.20) | 82 (46.59) | 25 (14.20) | |
| Unknown | 724 (25.25) | 315 (43.51) | 349 (48.20) | 60 (8.29) | |
| History of imprisonment | | | | | |
| Yes | 1,693 (59.05) | 1,120 (66.15) | 409 (24.16) | 164 (9.69) | < 0.001 |
| No | 595 (20.75) | 181 (30.42) | 364 (61.18) | 50 (8.40) | |
| Unknown | 579 (20.20) | 516 (89.12) | 10 (1.73) | 53 (9.15) | |
| Sex with non-spouse | | | | | |
| Yes | 716 (24.97) | 388 (54.19) | 257 (35.89) | 71 (9.92) | < 0.001 |
| No | 289 (10.08) | 48 (16.61) | 213 (73.70) | 28 (9.69) | |
| Unknown | 1,862 (64.95) | 1,381 (74.17) | 313 (16.81) | 168 (9.02) | |
| Unsafe sexual behavior | | | | | |
| Yes | 1,336 (46.60) | 725 (54.27) | 479 (35.85) | 132 (9.88) | < 0.001 |
| No | 748 (26.09) | 390 (52.14) | 286 (38.24) | 72 (9.63) | |
| Unknown | 783 (27.31) | 702 (89.38) | 18 (2.30) | 63 (8.05) | |
| WHO clinical staging of HIV/AIDS | | | | | |
| Stage 1 (asymptomatic) | 447 (15.59) | 267 (59.73) | 156 (34.90) | 24 (5.37) | < 0.001 |
| Stage 2 | 652 (22.74) | 175 (26.84) | 409 (62.73) | 68 (10.43) | |
| Stage 3 | 477 (16.64) | 266 (55.77) | 134 (28.09) | 77 (16.14) | |
| Stage 4 (AIDS) | 185 (6.45) | 70 (37.84) | 67 (36.22) | 48 (25.95) | |
| Unknown | 1,106 (38.58) | 1,039 (93.94) | 17 (1.54) | 50 (4.52) | |

*HBV – hepatitis B virus, HCV – hepatitis C virus, TB – tuberculosis*

duration of HIV/AIDS in women was 11.54 years (95% CI: 10.76-12.32%), and in men was 11.89 years (95% CI: 11.44-12.35%). According to the WHO classification, 185 patients (6.45%) were identified as stage 4 (AIDS). During the study period, 1,591 patients died, and the most important cause of death was AIDS, followed by suicide and substance abuse, and AIDS-related infections, with 354 (36.9%), 178 (18.5%), and 110 (11.4%) patients, respectively. Of the 1,276 living patients in this study, 773 (60.58%) are currently receiving ARV treatment.

Among HIV/AIDS patients, 98 (3.42%), 394 (13.74%), and 776 (27.07%) had HBV, HCV, and TB infections, respectively. Among the HIV/AIDS risk factors, 2,143 (74.75%) were history of drug abuse, 1,967 (68.61%) history of drug injecting, 1,693 (59.05%) history of imprisonment, 1,584 (55.25%) of needle sharing, 1,336 (46.60%) of unsafe sexual behaviors, and 716 (24.97%) of non-spouse sex (Table 1).

In terms of treatment status, 1,817 people with HIV/AIDS (63.38%) were non-adherent to medication, and 783 (27.31%) were adherent to ARV; the rest of patients showed cessation of ARV. As presented in Table 1, adherence to ARV was higher in women, married people, and in age and education. Also, those who did not share needles, with no history of drug abuse, no history of injection drug use, no history of imprisonment, no sex with non-spouse, and no unsafe sexual behaviors had a higher percentage of adherence to treatment than those who presented these behavioral risk factors (Table 1).

The HIV/AIDS treatment trend shows that in 1995, more than 90 percent of people were non-adherent to treatment, while in 2019, more than 67 percent of those studied were adherent to treatment. The treatment process has been on the rise since 2005, the trend of cessation of treatment between 1995 and 2019 was almost constant and close to 8% (Figure 2).
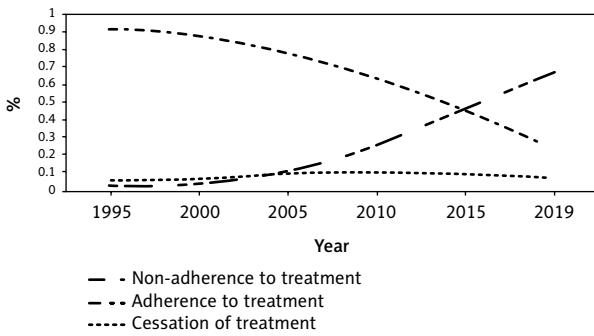
**Figure 2.** Treatment trend of people with HIV/AIDS based on treatment pattern
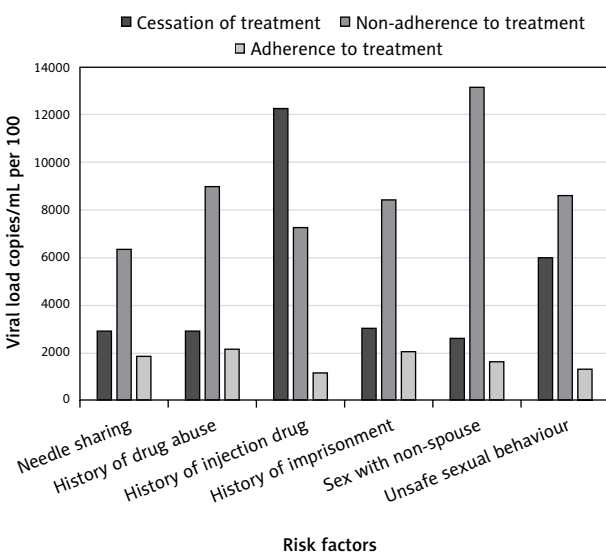


**Figure 3.** Viral load measures in risk factors of HIV infection transmission based on the status of ARV treatment

All behavioral risk factors were associated with non-adherence to treatment. In general, after controlling the confounding variables, except needle sharing, all behavioral variables affected adherence. The greatest impact on non-adherence treatment was history of drug abuse, history of imprisonment, history of injection drug use, and sex with non-spouse, with a chance of 10.87 (range, 7.21-16.39), 3.94 (range, 2.84-5.46), 3.86 (range, 2.47-6.03), and 3.38 (range, 2.19-5.23) times more than patients without these risk factors to follow the treatment (Table 2).

Although the effect of behavioral risk factors on cessation of treatment was not as significant as non-adherence to treatment, after controlling the variables, the most important factors in cessation of treatment were observed in patients with a history of drug use and history of imprisonment. The chances of cessation of treatment in patients with a history of drug use and history of imprisonment were 4.15 (range, 2.37-7.25) and 2.21 (range, 1.35-3.61) times higher

than in patients without these risk factors in adherence to ARV, respectively (Table 2).

In general, viral load (VL) level varied in different behavioral risk factors in individuals with cessation of treatment or non-adherence to ARV ($p < 0.001$), such as the VL level was significantly higher among patients with cessation or non-adherence to ARV than in those with adherence to treatment, and it was almost the same in these patients ($p = 0.19$). The highest VL level of non-adherence to treatment was related to individuals who had sex with non-spouse. Moreover, the highest VL level in patients with cessation of treatment was with history of injection drug use (Figure 3).

## Discussion

HIV/AIDS has become a major obstacle in the development of human societies, and a major concern of people around the world. HIV in all countries, rich and poor, is not only a health problem, but also a socio-cultural and economic problem for human societies.

In this study, 85.42% of all people living with HIV were males. According to the WHO in 2018, of the 37.9 million people living with HIV, 18.8 million were women and 17.4 million were men [1]. In a study of nine US patients, nearly a quarter of women were infected [15]. The most important reason for the difference in sex ratio of HIV/AIDS patients in different countries is the way of the disease transmitting. In Iran, due to the fact that injecting drug use is the most common way of transmission, more than 80% of infections are observed in men, but in recent years, with the change in cause of infection and the increase in sexually transmitted diseases, the prevalence of HIV/AIDS in women is increasing quickly [8].

In this study, there was a significant relationship between gender and treatment status. Thus, receiving treatment and adhering to treatment was higher in women than men. The results of a study in the United States showed that women were less likely to receive treatment [16]. In our study, the cessation of ARV in both sexes was consistent with the findings of similar studies [17-19]. These gender differences are largely explained by social and behavioral factors. In addition to the regularity and high commitment of women versus men in adherence to treatment, antiretroviral treatment can be provided to prevent mother-to-child transmission, which has been included in the national guidelines for care and treatment since 2016 [20].

There is a statistically significant relationship between education and treatment. As the rate of education increased, the treatment increased and non-adherence to medication decreased, which was consistent with the results of a study [21]. One of the reasons for non-adherence in illiterate people is not using daily calendars, reminder notes, diet instructions, and devices, such as timers and alarms, which require minimal level of literacy.

In the analysis of marital status, there was a statistically significant relationship between marital status and adherence to treatment, such that adherence was higher in married people, which was in line with the results of a similar

**Table 2.** Results of crude and adjusted multivariate logistic regression analysis of non-adherence and cessation compared to adherence to antiretroviral therapy

| Behavioral risk factors | Model 0 OR (95% CI) | Model 1 OR (95% CI) | Model 2 OR (95% CI) | Model 3 OR (95% CI) |
|---|---|---|---|---|
| Non-adherence to ARV compared to adherence to antiretroviral therapy | | | | |
| History of drug abuse | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 12.36 (9.54-16.02%) | 9.75 (6.99-13.60%) | 9.38 (6.42-13.72%) | 10.87 (7.21-16.39%) |
| Unknown | 101.27 (49.99-205.19%) | 79.78 (38.29-166.21%) | 75.34 (34.95-162.42%) | 72.04 (32.12-161.57%) |
| Needle sharing | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 2.19 (1.35-3.57%) | 2.15 (1.31-3.53%) | 1.58 (0.91-2.74%) | 1.40 (0.80-2.47%) |
| Unknown | 0.93 (0.57-1.51%) | 1.55 (1.00-1.06%) | 1.27 (0.72-2.22%) | 0.99 (0.55-1.79%) |
| History of injection drug use | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 4.84 (3.44-6.80%) | 3.53 (2.46-5.05%) | 3.42 (2.28-5.14%) | 3.86 (2.47-6.03%) |
| Unknown | 1.07 (0.75-1.52%) | 1.25 (0.86-1.82%) | 1.22 (0.80-1.87%) | 1.02 (0.64-1.63%) |
| History of imprisonment | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 5.51 (4.46-6.80%) | 3.47 (2.68-4.51%) | 3.27 (2.42-4.42%) | 3.94 (2.84-5.46%) |
| Unknown | 103.77 (54.14-198.91%) | 68.80 (35.39-133.75%) | 67.84 (34.13-134.85%) | 60.67 (29.82-123.48%) |
| Sex with non-spouse | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 6.70 (4.72-9.51%) | 3.81 (2.61-5.57%) | 3.87 (2.55-5.89%) | 3.38 (2.19-5.23%) |
| Unknown | 19.58 (13.99-27.41%) | 11.59 (8.09-16.61%) | 10.53 (7.08-15.66%) | 8.27 (5.47-12.50%) |
| Unsafe sexual behavior | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 1.11 (0.92-1.34%) | 1.19 (0.97-1.46%) | 1.35 (1.07-1.70%) | 1.53 (1.19-1.96%) |
| Unknown | 28.6 (17.48-46.78%) | 24.22 (14.70-39.90%) | 25.48 (15.21-42.67%) | 27.23 (15.93-46.55%) |
| Cessation of ARV compared to adherence to antiretroviral therapy | | | | |
| History of drug abuse | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 4.30 (2.92-6.32%) | 3.93 (2.34-6.59%) | 3.83 (2.22-6.59%) | 4.15 (2.37-7.25%) |
| Unknown | 24.76 (10.67-57.45% ) | 26.19 (1.87-63.08%) | 24.01 (9.76-59.53%) | 0.63 (0.34-1.17%) |
| Needle sharing | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 1.32 (0.62-2.78%) | 1.28 (0.61-2.73%) | 1.21 (0.56-2.63%) | 1.15 (0.50-2.62%) |
| Unknown | 0.69 (0.32-1.46%) | 1.01 (0.47-2.21%) | 1.05 (0.47-2.34%) | 0.82 (0.35-1.94%) |
| History of injection drug use | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 1.69 (1.04-2.75%) | 1.63 (1.00-2.67%) | 1.43 (0.86-2.40%) | 1.64 (0.95-2.84%) |
| Unknown | 0.56 (0.33-0.95%) | 0.71 (0.40-1.25%) | 0.67 (0.37-1.20%) | 0.63 (0.34-1.17%) |
| History of imprisonment | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 2.91 (2.06-4.13%) | 2.22 (1.41-3.51%) | 1.98 (1.24-3.17%) | 2.21 (1.35-3.61%) |
| Unknown | 38.58 (18.45-80.67%) | 34.17 (15.82-73.80%) | 31.21 (14.26-68.34%) | 21.54 (9.42-49.24%) |

**Table 2.** Cont.

| Behavioral risk factors | Model 0 OR (95% CI) | Model 1 OR (95% CI) | Model 2 OR (95% CI) | Model 3 OR (95% CI) |
| --- | --- | --- | --- | --- |
| Cessation of ARV compared to adherence to antiretroviral therapy | | | | |
| Sex with non-spouse | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 2.10 (1.31-3.37%) | 1.45 (0.86-2.42%) | 1.59 (0.94-2.69%) | 1.53 (0.89-2.62%) |
| Unknown | 4.08 (0.64-6.32%) | 3.13 (1.96-4.99%) | 3.13 (1.94-5.06%) | 2.51 (1.52-4.12%) |
| Unsafe sexual behavior | | | | |
| No | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 1.09 (0.79-1.51%) | 1.18 (0.85-1.65%) | 1.24 (0.88-1.74%) | 1.37 (0.95-1.96%) |
| Unknown | 13.90 (7.75-24.93%) | 14.52 (7.94-26.54%) | 13.85 (7.48-25.67%) | 11.09 (5.5-21.37%) |

*OR – odds ratio, CI – confidence interval*

*Model 0: crude odds ratio with 95% confidence interval of risk factors. Model 1: adjusted for gender, age, job, educational, and marital status. Model 2: adjusted for model 1, HBV, HCV, and TB. Model 3: adjusted for model 2, CD4+, and WHO stages.*

study [22]. Couples support may have increased the use of treatment after disclosure of the disease. This form of support may not exist in single people.

In this study, 59.05% of participants had a history of imprisonment, of which 66.15% did not adhere to treatment. After controlling the confounding variables, the chance of cessation of treatment in patients with a history of imprisonment of 2.21 (range, 1.35-3.61) was equal to that of patients with no history of imprisonment in compliance with treatment. In prisons, people are kept in a closed environment for a long time, and with conditions, such as overcrowding, poor nutrition, lack of medical care, and sexual contacts with homosexuals, violence, rape, and tattooing with contaminated equipment, these people are prone to infection. They become infected with a variety of diseases and, after being released, they can spread these diseases into the community. To reduce the risk of transmitting the disease to prisoners, it has been suggested that measures, such as informing and raising prisoners' levels of information, screening, providing sterile condoms and syringes, treating patients, and vaccinating individuals can reduce the risk of transmission, should be implemented. In two prisons in Germany, in addition to training and raising public awareness, sterile injections were also required, which reduced both the percentage of injecting drug use and the use of shared needles and ultimately, reduced the chances of HIV, and hepatitis B and C transmission [23]. Therefore, programs that ensure the continued care of HIV-positive patients after release from prison as well as awareness of negative consequences of ARV cessation, require further development and evaluation.

After controlling the confounding variables, the chance of cessation of treatment in patients with a history of drug use was 4.15 (range, 2.37-7.25), and it was higher than without a history of drug abuse patients. Results of similar studies showed that drug use was associated with less adherence to antiviral treatment, and accelerated progression of HIV [24-26]. For people who are taking drugs, special considera-

tions, such as the impact of their unstable lifestyles, problems with adherence to treatment, and the effect of methadone maintenance treatment on antiretroviral treatment, are factors that should be considered. Also, although alcohol and non-injectable drugs do not expose a person to direct contact with other people's blood, they can impair their ability to think, and lead to dangerous behaviors (especially during sexual intercourse) that they do not perform under normal circumstances.

In the present study, 46.60% of patients had unprotected sex. Considering that sexual contact is one of the ways of HIV transition, the correct use of condoms and avoidance of multiple sexual partners are always recommended.

The results of multivariate logistic regression analysis showed a statistically significant relationship between non-adherence to ARV and unsafe sexual behavior, so that the chance of non-adherence to treatment in patients with unsafe sexual behaviors was 1.53 times more than in patients without unsafe sexual behaviors. According to a study in Cameroon, patients who did not receive treatment reported unsafe sexual behaviors from one and a half to three times more than their treated counterparts [27]. Interventions can maintain health of the individual and society by emphasizing commitment to treatment, and by knowing that antiretroviral treatment can significantly reduce the likelihood of HIV transmission through sexual behaviors [28].

The HIV/AIDS treatment diagram shows that the trend of receiving treatment has been on a steep rise since 2005. With the introduction of HIV epidemic in 1996, in some Iranian prisons, the number of identified cases suddenly increased dramatically, and this trend continued until 2004, when the total number of identified cases reached a maximum in one year [29-31].

Patients with risk factors who did not adhere to treatment, had higher levels of VL than patients with risk factors who were adherent to treatment. When patients adhere to treatment properly, HIV virus changes from a potentially deadly condition to a potentially controllable chronic dis-

ease [32]. Therefore, creating a context for receiving treatment in patients with risk factors seems necessary.

## Limitations and strengths

The most important strengths of this study are the high dimension of the sample and its' population-based nature as well as long-term period of the study, the collection of information by trained individuals, and its' accurate recording being the only comprehensive, available, and reliable data on HIV patients in Kermanshah. The study was limited in the fact that about 21% of patients who adhered to treatment had a history of drug use and are currently being treated with methadone, or are currently taking drugs, so there is a need to accurately record drug abuse information. We did not ask participants about rape, forced sex, pressing, and tattooing as risk factors for HIV transmission. These factors are important in assessing the risk of HIV infection as well as reasons, such as accusing and discrimination against people living with the disease, concomitant infections, including tuberculosis, sexually transmitted infections, and hepatitis. However, these patients did not tend to do laboratory tests and antiretroviral treatments, so they remain unknown.

## Conclusions

Although the process of receiving treatment has been on the rise since 2005, there is still non-adherence to medication in high-risk groups, such as people with a history of drug abuse and needle sharing, people with a history of imprisonment, and in individuals with unsafe sexual behaviors.

## Recommendations

As mentioned above, since non-adherence to treatment in high-risk groups can be considered as an important factor in increasing the level of VL, HIV transmission, and prevalence, it is necessary to focus more on health education, increasing the awareness to reduce non-adherence and eventual cessation of treatment, continuity of care for HIV-infected patients as well as the emergence of non-governmental organizations to provide harm reduction programs to HIV patients.

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## Conflict of interest

The authors declare no conflict of interest.

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